

REMARKS

It is proposed to amend the claims after final rejection to place them in condition for allowance and to place them in better condition for appeal. Claim 1 has now been amended to claim a method of making a mould, which mould is suitable for moulding materials to an optical component ; and Claims 7 and 19 have been amended to claim a method for making an optical component comprising making the mould and curing moulding material to obtain the optical component, support being found throughout the specification as filed, see for example page 7, line 29 to page 8, line 2. Claims 2, 8, and 14 have been amended to delete thiols groups, and Claim 6 to insert suitability for use to make optical lenses and in replication of at least 100 lenses. The proposed changes were not previously made because certain of the issues were not fully crystallized until the last Office Action. No new matter is involved and new issues are not raised. Accordingly, entry of the Amendment is requested.

Claims 1-21 are in this case.

Claims 1, 2, 5-8, 11-14, and 17-18 stand finally rejected under 35 U.S.C. 103 (a), as unpatentable over Singh et al, US Patent 5, 204, 126 in view of Yamana et al, U.S. Patent 5, 804, 674.

Claims 3, 10 and 16 stand finally rejected under 35 U.S.C. 103 (a), as unpatentable over Singh et al, US Patent 5, 204, 126 in view of Yamana et al, U.S. Patent 5, 804, 674, in further view of Nakakimura et al, JP 10-190245.

Claims 4, 9, and 15 stand rejected under 35 U.S.C. 103 (a), as unpatentable over Singh et al, US Patent 5, 204, 126 in view of Yamana et al, U.S. Patent 5, 804, 674, in further view of Takahashi, “Improvement of Photo Cured Composite Resin Using Low Viscosity Monomer Substituted by Fluorine”, Journal of the Japanese Society for Dental Materials and Devices.

Claims 19 to 21 stand rejected under 35 U.S.C. 103 (a), as unpatentable over Singh et al, US Patent 5, 204, 126 in view of Nakakimura et al , JP 10-190245.

The present invention provides moulds and materials: with intrinsic release properties that can be shaped in the desired form , such as moulds with an aspherical lens profile; in which the profile may be controlled very accurately within tens of nanometers; in which the interfacial tension is such that release of the polymerised lens is facilitated; that provide excellent release of (photo)cured products from pre-shaped moulds made from these materials. In the invention, a mould is provided that omits the need for applying extra surface coatings on these moulds; and wherein the release properties remain constant even after high

numbers of products are cured and released from a mould prepared from said polymerisable materials.

In its preferred embodiments, this invention relates to moulds for making optical components, wherein the mould is at least partly produced from polymerisable compounds of formula Z-X-Y. Hence, the mould is prepared from compound Z-X-Y, whereas the optical component to be prepared inside the mould can be made of any moulding material providing the desired properties.

According to the invention, the polymerisable moieties Z and Y are of three types:

Type 1: derived from acrylic acid ($O-CO-C(R)=CH_2$)

Type 2: derived from epoxy/oxtetane compounds($O-CH_2$ -epoxy and $O-CH_2$ -oxetane)

Type 3: vinyloxy compounds ($O-(CH_2)_n-CH=CH_2$).

These are well known polymerisable monomers. However, to applicant's knowledge such moieties have not been joined with an X group as claimed herein and used in a moulding process to form a mould suitable for use in the moulding of optical components, which mould exhibits improved and unexpected properties. The X group moieties are perfluoro alkylidene groups (C_nF_m), wherein the number n is restricted to a small group of oligomers (n=2-20), to perfluorobenzene (n and m=0); or to a combination thereof (n and m = 1-4), and the moiety containing 2 perfluorobenzene moieties. Each of these moieties may be extended with a methylene, ethylene, or propylene group (the moieties $CR'CR''$, where n and/or m = 1-3). These are polymerisable bifunctional monomers that are to be contrasted with non-crosslinkable monofunctional monomers that do not form part of the polymer backbone.

Singh et al, U.S. Patent 5, 204,126, the primary reference relied on in the Office Action, relates to surface coatings for cookware, laboratory ware, glass and plastic eyewear lenses, and on internal surfaces of molds used for casting optical lenses of plastic materials, the surface coatings being formed from substances containing amphiphilic molecules that are critical to the operability of patentee's invention. According to patentee, amphiphilic materials contain distinct polar and non-polar regions and may include as the polar segment a carboxylic acid and its salts, alcohols, thiols, amides, amines, cyanides, nitrates, phosphates, silane derivatives, and sulfonates. As the apolar segment, components such as alkyl and alkyl ethers, fluorinated alkyls or alkyl ethers are disclosed which may include diacetylene, vinyl-unsaturated, fused linear or branched aromatic moieties, organic dyes, etc. Preferred film forming substances consist essentially of R_mSiX_n , wherein R is an alkyl and alkyl ether, fluorinated alkyl or alkyl ether group of about 6-30 carbon atoms, X is

halogen, hydroxyl and alkoxy, m is 0-3, n is 1-4, and m + n is 4. R may also be a substituted silane or siloxane. (See col. 4, lines 24-65). According to patentee, the amphiphilic molecules attach to a substrate from a composition such as petrolatum, paraffin waxes, etc. having a gel or gel-like state, instead of a liquid state, at a temperature below 20 degrees C. (col. 2, lines 23-28 and col.5, lines 8-20). Where the film forming substance contains a polymerisable group, it may be cured but polymerisable groups that are mandatory in the claimed invention are neither disclosed nor contemplated. (See col.6, lines 30-41). Patentee states at column 7, lines 23-28 "the sole material that forms the film in-situ on a substrate consists essentially of amphiphilic molecules. That is, the sole material in the finished film consists essentially of amphiphilic molecules from the film forming substance." (emphasis added). It is noted that patentee discloses at col. 8, lines 61-68 that the release coating provided therein was effective to be reused to cast not less than 10 lenses and preferably more than 20 lenses. The present invention provides a method for making a mould and a mould that is suitable for use in the manufacture of optical lenses and is effective without substantial deterioration of either lenses or mould after replication of at least 100 lenses.

It is clear that Singh et al does not disclose the claimed invention and does not render it obvious since it is directed to a method using different reactants and achieves different results as acknowledged by the Examiner.

Yamana et al, U.S. 5, 804, 674, the secondary reference does not cure the deficiencies of the primary reference, and, it is submitted, is not properly combined therewith in view of the primary reference disclosure that to be effective in the reference method, the sole material that forms the film must consist essentially of amphiphilic molecules which migrate to the surface and bond therewith. The secondary reference is contrary to this requirement. Yamana et al relates to release of rubber or a resin from a mould. To facilitate the release thereof a release agent is added. This release agent is a composition that comprises multiple compounds including (A) a silane compound (present to crosslink the component (B); (B)a silicon and/or fluorine-containing compound having at least two hydroxyl groups or alkoxy groups in one molecule; and (C) a polymer of a perfluoroalkyl group-containing (meth)acrylate ester, the component (C) being incorporated into the crosslinked (A) and (B) components during a cross-linking step. Essential to the operation of the reference is a silane (component A) and a silicon and/or fluorine-containing compound having at least two hydroxyl groups or alkoxy groups in one molecule (component (B), which are not disclosed by the primary reference as equivalents to the silanes, etc. disclosed therein. Yamana et al does not relate to the production of optical components; does not

suggest making a mould from perfluoroalkyl groups containing (meth) acryesters; and does not even suggest making a release agent from a polymer of a perfluoroalkyl group containing (meth)acrylester, because a silane compound and a compound with at least two hydroxyl or alkoxy groups are also required. The reference is concerned with the release of rubber products from a mould and optical components and their radically different moulding and release properties are not contemplated.

In addition, the polymer of the perfluoroalkyl group containing (meth)acrylester of Yamana et al is different from the presently claimed polymers and from the amphiphilic substances of Singh et al. In Yamana et al, the polymer is obtained from monofunctional monomers with the formula $H_2C=C(B^1)-CO-O-B^2-Rf^3$ wherein B^1 is H, F or CH_3 , B^2 is an alkylene group CH_2 to $(CH_2)_6$, and Rf^3 is a perfluoroalkyl group with 6-21 carbon atoms. The instantly claimed polymerisable materials are bifunctional monomers represented by the formula Z-X-Y as discussed in detail hereinabove, and give rise to fundamentally different polymers.

The combined Singh et al and Yamana et al references do not disclose or suggest a mould or method employing a polymerisable material as claimed herein. Moreover, the instant method allows elimination of the use of a release agent. In fact, the present invention provides a mould that eliminates the need for applying extra surface coatings on the moulds. Specification, page 4, lines 4-5. Finally, there is no motivation or suggestion in the art to combine these references. There is no sound reason why a person of ordinary skill in the art would combine a reference such as Singh et al that relates to surface coatings for cookware, laboratory ware, glass and plastic eyewear lenses, or amphiphilic coatings on internal surfaces of molds used for casting optical lenses of plastic materials, with Yamana et al relating to the release of a resin or rubber article from a mould.

The combination of (a) Singh et al, Yamana et al and Nakakimura to reject Claims 3,10 and 16; (b) Singh et al, Yamana et al and Takahashi et al to reject Claims 4,9 and 15; and (c) Singh et al and Nakakimura to reject Claims 19 to 21 are even more tortuous and untenable.

Nakakimura is an apparently inaccurate and incomprehensible translation, the accuracy of which is disclaimed at page 1 of the translation. To the extent that it is understood, the reference appears to relate to thin film surface coatings derived from 100 parts of a binder resin containing a fluorine compound, preferably such a compound having at least two polymerizing functional groups, an organic silicon compound of formula $Si(r1)i(r2)j(r3)k(OR4)4-(i+j+k)$ wherein R1, R2 and R3 are each an organic group having at

least one H, O and F; R4 is an aliphatic , alicyclic or aromatic residue; and i, j and k are each 0 or 1, and a small particle which may be an inorganic oxide, etc. The Examiner asserts

"Nakakimura et al discloses [Formula 5, page 17] which is the starting material of the claimed invention comprising glycidylether groups used for optical lenses. It would have been obvious to one of ordinary skill in the art to have incorporated the starting material of Nakakimura et al for the method of molding optical lenses of modified Singh et al for the purpose of fabricating an optical device from a material known in the art to be suited for optical applications."

Applicant submits that this conclusion is not the result of any teaching to be found in the reference. Nakakimura et al at page 1 discloses that his invention is related to thin film used as antireflection films, useful for articles such as a case for exhibition, a show window and the frame for pictures, a windowpane, an optical lens, and a glass lens, etc. The reference is devoid of any disclosure whatsoever of a moulding process or of a moulding process for optical lenses as claimed. The working examples make it clear moulding is not involved and that the coatings in question are surface coatings derived by conventional gravure coating process. Moreover, an organic silicone is an essential component of the reference composition while such is not a required component herein. Finally, there is no motivation or suggestion in the art to combine these references. There is no sound reason why a person of ordinary skill in the art would combine a reference such as Singh et al that relates to surface coatings for cookware, laboratory ware, glass and plastic eyewear lenses, or amphiphilic coatings on internal surfaces of molds used for casting optical lenses of plastic materials, with Yamana et al relating to the release of a resin or rubber article from a mould using a silicon release agent with Nakakimura et al relating to antireflection films for articles such as a case for exhibition, a show window and the frame for pictures, a windowpane, an optical lens, or a glass lens applied by gravure coating.

The combination with Takahashi is the best evidence of the improper use of hindsight to use Applicant's discovery against him. Since no translation has been provided, and specific portions of the reference are not pointed to by the Examiner, Applicant has relied on the English-language Abstract. The Examiner asserts that Singh et al does not disclose 2,2,3,3,4,4,5,5-octafluoro1,6,hexanediol-dimethacrylate specifically claimed herein in Claims 4, 9 and 15 but the use of the same in Singh et al as modified by Yamana would be obvious since Takahashi discloses a photocurable fluorinated monomer FHDDMA. Applicants are not claiming to be the first to use perfluoromonomers regardless of the purpose. What is the motivation for combining Takahashi? The Abstract does not disclose a use for the compound. It is noted that reference is an article published in the Journal of the Japanese Society For

Dental Materials and Devices. Again, the references are incongruous and improperly combined.

The instantly claimed invention obtains unexpected results that would not be predictable to those skilled in the art having the cited references before them. As discussed in the specification at pages 1 to 4, the present invention relates generally to a method of moulding materials to an optical component, for example a lens, using a mould made from a selected polymerisable bifunctional fluorinated compound. The mold may contain several components, and if the mould contains such components the surfaces of these components together form the moulding cavity in which the lens is made. The polymerisable bifunctional fluorinated compounds are selected to obtain a mold wherein the interfacial tension between the mould and the moulded article is such that the release of the moulded article from the mould is facilitated.

The method is particularly applicable in a replica process which uses a mould or matrix having an accurately defined surface which is the negative of the desired optical profile of the replica lens and in which in the exact determination of the definition of the surface of the mould or matrix, the shrinkage of the synthetic resin of the replica lens has been taken into account. A small quantity of a liquid curable synthetic resin composition is provided on the surface of the mould. The lens body is then pressed with its refractive surface against the mould, or conversely, the synthetic resin spreads between the lens body surface and the mould surface. Instead of the mould, the lens body may alternatively be provided with the liquid synthetic resin composition. The synthetic resin is cured and the lens body together with the cured synthetic resin layer bonded thereto is removed from the mould. The free surface of the synthetic resin layer is the negative of that of the mould. See the specification, page 1. While such processes have many advantages, problems persist related to shrinkage, the development of large mechanical forces in the mould, premature release difficulties, adhesion of the lens formed to mould parts, etc..

Those working in the field have sought various solutions to these problems and have not been successful. Among methods tried has been the incorporation of additives such as zinc stearate in the mould materials or the inclusion of mould release agents. Unfortunately, these agents can adversely affect mould surface texture or bulk polymer properties. Adjustments to the time, temperature, and heating profile of the cure and demould processes has also been used to affect the adhesion of the lens to at least one of the mould parts. Often, the adjustments to the cure and demould processes that might be helpful in solving the adhesion problem negatively affect the quality of the lens made. Mechanical and

optical properties can be seriously eroded or altered. Materials with a low interfacial tension are known and often contain no or little polar groups and Si-O or F containing groups. For example, well-known fluoropolymers with low interfacial tension are teflon and teflon-copolymers (Kel-F, AF1600, etc). Other coatings have been applied on a mould for replication of lenses from materials with low polymerization shrinkage gaining an initial satisfactory release but also a fast deterioration of the lens due to wear of the mould. In practice less than 10 lenses could be released. Other strategies, such as adding reactive release agents to the mould-making formulation, can be followed to improve release from the mould, but have not been successful. In one application, the replication of aspherical lenses for read-out of optical discs, glycidyl 3-(pentadeca-dienyl)phenylether (b.p. 305°C) has been added as co-reactive additive to the conventional DGEBA-diphenyliodonium antimonyhexafluoroarsenate/anthracene mould formulation but this remained without improvement of the release properties in this demanding application aiming at the replication of a mould in which the replicating monomer is confined in a closed cavity. The same was observed upon the addition of 0.1% (epoxycyclohexylethyl)methylsiloxane(2-3%)-dimethylsiloxane(97-98%) copolymer to the mould-making formulation. The addition of glycidyl 1,1,2,2-tetrafluoroethyl ether (b.p. 143°C) also proved unsuccessful. See the specification at pages 2 and 3. In contrast, the present invention provides intrinsic release, and after numerous replications, after 100 replication of 100 lenses in Example 3, no deterioration of either lens or mould surface had occurred and mould release remained high.

It should be apparent from the above that the Examiner's assertion of obviousness flies in the face of the failure of those skilled in the art to achieve similar results with various compounds, and appears to be based on impermissible hindsight and the use of applicant's disclosure against him. The Federal Circuit has stated that "rejections on obviousness cannot be sustained with mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006). See also *KSR*, 550 U.S. at ___, 82 USPQ2d at 1396 (quoting Federal Circuit). The rejections are untenable and should be withdrawn.

In view of the above remarks and amendment to the claims, it is respectfully submitted that the present application is in condition for allowance. A Notice of Allowance is earnestly solicited.

Respectfully Submitted,

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